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Comprehensive Bibliometric Analysis of Curcumin Research: Trends and Developments from 1937 to 2025

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ABSTRACT

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Curcumin is a bioactive compound produced from turmeric (Curcuma longa) with multiple health benefits and potential therapeutic applications. Due to its pharmacological activities and potential to address various diseases, several investigations have been carried out to provide comprehensive bibliometric analysis of curcumin research from 1937 to 2025. Therefore, this research aimed to elucidate the trends and developments of curcumin by examining various bibliometric markers, including article count, citation count, and H-index. By using Scopus database and VOSviewer (Visualization of Similarities Viewer) software, the analysis identified key contributors, journals, and countries that had significantly influenced the understanding of curcumin's properties and applications. The results showed that there was a significant growth in research activity over the years, with India serving as a major contributor, followed by the United States. The International Journal of Biological Macromolecules and the Journal of Ethnopharmacology were identified as top journals in terms of article count and citations. Furthermore, keyword co-occurrence and collaborative networks among authors, institutions, and countries were investigated. By providing a quantitative perspective on the evolution of curcumin research, this analysis offered valuable insights into current hotspots and future directions in the dynamic multidisciplinary field. These results were expected to attract research teams and motivate further exploration of curcumin's medicinal potential, particularly in wound healing, anti-inflammatory, and anti-cancer applications.

Keywords: bibliometric analysis, curcumin, pharmacological activities, research trends, therapeutic applications

Introduction

Curcumin is a natural chemical (orange-yellow colored) discovered in turmeric (Curcuma longa). Traditionally, turmeric has been used as a colorant, food flavoring agent, and a medicinal herb popular in various Asian countries.¹⁻⁴ Furthermore, curcumin (1,7-bis4hydroxy-3-methoxyphenyl-1,6-heptadiene-3,5-dione) has several advantages. including antitumorigenic, anti-inflammatory, immunomodulatory, and antioxidant qualities, making it the most potent polyphenol molecule in turmeric.5,6 These qualities are influenced by the regulation of several transcription, growth factors, inflammatory cytokines, protein kinases, and other enzymes.7,8 Curcumin is lipophilic but maintains stability in the acidic pH of the stomach.^{1,9-11} Due to these numerous benefits, several investigations have been carried out to enhance the bioavailability ^{3,12–14} and increase the effectiveness of curcumin for therapeutic use.^{15–17}

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A bibliometric analysis of research trends on curcumin as a therapeutic agent for treating various diseases is essential to obtain a comprehensive overview, predict future directions, and enhance clinical application.¹⁸⁻ ²⁰ Additionally, the ongoing pandemic has led to the continuous search for the most effective, safe, and affordable treatments for various clinical conditions. 10,21,22 In line with recent research, the scientific community and the general public benefit from bibliometric mapping, which converts publication metadata into easily digestible maps or visualizations, facilitating the extraction of valuable insights.^{10,23,24} For instance, keyword visualization can help identify research topics or clusters in specific fields, and author affiliations mapping of specific publications might show the geographical spread of the journal. Institutional and international collaboration mapping also provides a methodology for discovering recent innovations.^{8,25} In this context, the application of bibliometric analysis ranges from evaluating publication patterns to exploring collaboration structures, manifesting in the form of journals.[10,26,27] Bibliometric analysis is used to provide a retrospective review of journals, showing insights into the research state-of-the-art and the progress of curcumin.

Currently, there has been no research that focuses on a bibliometric analysis of curcumin, particularly in terms of the use in treating diseases across different countries. Therefore, this research aimed to analyze the development of curcumin as a therapeutic agent. The analysis focused on document data related to curcumin therapy, keywords, the countries producing publications on curcumin-based treatments, and global collaboration data. The results were expected to contribute to the

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development of curcumin as a medicine in Indonesia, helping authors to identify gaps in curcumin-based treatment.

Materials and Methods

A bibliometric method was used in this research to analyze scientific publications, including articles, books, conference papers, and journals.^{28–31} This method also allows quick identification of high-impact articles, exploring relevant directions in the scientific community, and assessing the performance of previous research based on evolving publication trends. The analysis covers various aspects such as institutions, countries, authors, funding bodies, and related disciplines.^{22,32}

In this research, information on the use of curcumin to treat a variety of diseases was gathered from Scopus database between 1937 to 2025. Data collection was systematically conducted on September 18, 2024. VOSviewer (Visualization of Similarities Viewer) 1.6.20 software was used to evaluate data such as authorship mapping, number of publications, and citations in CSV format. This software was developed

by Nees Jan van Eck and Ludo Waltman from the Center for Science and Technology Studies (CWTS) at Leiden University in the Netherlands for the analysis and evaluation of publication data in various fields. Furthermore, VOSviewer was intended to generate and show bibliometric maps, such as authorship, co-authorship, cooccurrence, and citation-based maps. It is also capable of processing information from a number of bibliographic databases and integrating with additional analysis tools. In this research, VOSviewer was used to show institutional collaboration and map institutions included in citations.^{22,33,34}

The keywords used for a precise and efficient search were "curcumin," "curcuminoid," and "disease," focusing on English-language articles published between 1937 and 2025. The database search obtained 17339 articles, comprising 17269 finalized articles and 70 in press. Only English-language articles were selected, totaling 16978, while the remaining were in other languages, comprising 191 Chinese, 34 Russian, 36 German, 26 Persian, and 74 various other languages. The flowchart of article selections is shown in Figure 1.



Figure 1: Flowchart of article selection

Result and Discussion

The data obtained from Scopus database was analyzed to extract key information regarding research on curcumin and therapeutic

applications by using VOSviewer, covering the period from 1937 to 2025. This analysis included the types of documents, the publications per year (on average), citation counts, and the contribution of authors to publications, as shown in Table 1.

Table 1: Study data on curcumin in relation to therape	eutic applications from 1937 to 2025
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Description	Results				
MAIN INFORMATION					
Time Range	1937 - 2025				
Sources (Journals, Books, etc)	2229				
Documents	8438				
Annual growth rate%	0,79				
Average Document Age	6,62				
Average Citations per Year per Document	41,18				
References	431317				
DOCUMENT TYPE					
Articles	8438				
DOCUMENT CONTENTS					

Keywords Plus (ID)	44556				
Author's Keywords (DE)	15145				
AUTHORS					
Authors	31500				
Authors of single-authored documents	211				
AUTHORS COLLABORATION					
Single-authored documents	219				
Co-Authors per Documents	6,29				
International co-authorships %	21,43				

Publication Trends from 1937-2025

From 1937 to 2025, there was a considerable growth in the number of articles connected to the usage of curcumin, as shown in Figure 2. Every article in this dataset was categorized as scientific, totaling 8438 publications, with an annual growth rate of 0.79%. From 1937 to 1980, scientific output was relatively low and stable, with approximately no significant publications. However, a substantial increase in production became evident between 2000 and 2015, with the peak occurring in 2018 and 2020, where over 800 articles were published annually. The growth showed global collaboration, advancements in research technology, and greater access to sophisticated data as well as scientific methods. The significant increase in international scientific publications from 2018 to 2020 could be attributed to several factors. These include government and institutional policies, such as in Indonesia, which promoted scientific publication, high funding, and enhanced international collaboration. Additionally, advancements in information technology facilitated easier access to scientific literature, data, and collaboration platforms, enhancing research and publication processes. The significant increase in the number of such articles was followed by a decline after 2020. This was due to changes in research trends which prioritized reports on global health issues related to the COVID-19 pandemic. Therefore, research on curcumin experienced delays in the process of submitting articles, peer review, and publication. A total of 31500 authors contributed to the publication, with 211 articles published without collaborators.





Topic Analysis Using the Keywords of the Authors

Keywords have an important function in aiding the search for articles relevant to specific fields and help show how research develops holistically. In publications related to curcumin trends, as shown in Figure 3, the most dominant keyword is "curcumin," indicating the central focus of research. The majority of research trends concentrate on the medical field, exploring curcumin's therapeutic potential, particularly as an anti-inflammatory, anti-cancer agent, and neuroprotective effects on neurodegenerative diseases such as Parkinson's, Alzheimer's, and brain inflammation. The wisdom and scientific credibility of curcumin as a therapy has been strengthened by many scientific reports, which are also supported by epidemiological data. This is confirmed by the consumption of curcumin, which plays a role in overcoming various diseases, particularly inflammation.⁴

Additionally, various articles to improve the clinical effectiveness either in vivo or in vitro are highly developed including structural modification, and combination therapy as well as improving the pharmacokinetics and pharmacodynamics of curcumin.³⁵ Advancements in nanotechnology are shown in efforts to address the clinical limitations of curcumin, with topics such as nanocurcumin, liposomes, and chitosan becoming prominently in the visualization.³⁶ These are closely related to drug delivery systems. The visualization also shows significant collaboration between medical, pharmaceutical, and material technology fields to optimize curcumin's clinical applications as an effective and precise therapeutic solution.



Figure 3: The most common keywords related to curcumin as therapeutic applications

Research Collaboration among Countries on Current Trends in Curcumin

The data of current trends on curcumin research regarding the most cited countries is shown in Figure 4. Based on the reports, 10 countries have published most articles on curcumin worldwide. Specifically, the United States of America ranked first with over 75000 articles, followed by China and India with over 64300 and 7000 articles, respectively. There are between 2000 and 5000 fewer articles in countries like Japan, Korea, Italy, and Iran. To further understand the variables that affect the quantity of articles, such as access to scientific journals, international collaboration, and national research policy, more research is required. The United States, China, and India are the top three countries with the most contribution to research. The trend towards healthy lifestyles and the increasing interest in natural-based medicines have made medicinal plants increasingly attractive as an alternative treatment.³⁷ In addition, the high cost of conventional medicines has made herbal medicine a favorite option for many people, increasing research trends on plants.³⁸ Figure 5 shows the top 20 correspondences by author and country of research on curcumin.

2200



Figure 4: Top 10 most cited countries of current trends of curcumin



Figure 5: Top twenty correspondences by author country of research on curcumin

The Most Cited Journal on Therapeutic Applications of Curcumin

Regarding the country of origin of authors in scientific research, Figure 6 presents a different picture. Authors from the same country are classified as Single Nation Publications (SCP). Meanwhile, Multiple Country Publications (MCP) are publications from collaboration between countries, based on correspondence.²⁵ China is the country with the most publications, having produced over 1800 articles. Although a tiny percentage is included in international cooperation, the majority of publications are carried out domestically. This is followed by India and the USA (United States of America) with a more equitable proportion of articles between SCP and MCP. Certain countries, like Canada, Germany, and Turkey, have larger MCP proportions than others, suggesting a stronger propensity for international cooperation. These cross-country collaborations are important for increasing the global impact of research and reaching a wider network of authors. Indonesia has a significant contribution, occupying a middle position, below countries such as Egypt, Brazil, and Australia. Most publications from Indonesia are domestic research with fewer international collaborations. However, the country still has great potential to increase the number of scientific publications, particularly by using international collaborations and strengthening research infrastructure.

The top 10 most cited journal sources from 1937 to 2025 are shown in Figure 6. The list includes top journals known for their impact in the fields of molecular sciences, chemistry, and biomedicine. The Plos One Journal received the most citations (122). International Journal of Molecular Science 103, and Scientific Report 77. Other significant journals include *RSC Advances, European Journal of Medicinal Chemistry*, and *Biomedicine & Pharmacotherapy*, which cover pharmaceutical applications, therapeutic potentials, and medicinal chemistry breakthroughs related to curcumin. These sources reflect the increasing academic focus on curcumin therapeutic properties and potential as a treatment for diseases through various interdisciplinary methods.



Figure 6: Most cited journal sources of curcumin

The Most Productive Affiliation Publications Related to Current Trends of Curcumin

Figure 7 shows the scientific article production of 5 leading universities (Mashhad University of Medical Sciences, Sichuan University, Sun Yat-Sen University, Tehran University of Medical Sciences, and Wenzhou Medical University) over the time period from 1997 to 2024. The variable on the Y-axis represents the number of articles published, while the X-axis indicates the year of publication. Generally, article production from each university shows a consistently increasing trend after 2009, with a significant acceleration from 2013 to 2024. Mashhad University of Medical Sciences and Sichuan University show the highest production rates, with more than 400 articles by 2024. Other universities show strong growth and have slightly lower production rates with the 300 articles range. In 2009, a significant acceleration of exponential growth was observed in research trends, particularly between 2012 and 2017, when the largest increase in article production was obtained from every university.



Figure 7: The most productive affiliation publications related to current trends of curcumin

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The Most Cited Journal on Therapeutic Applications of Curcumin Table 2 presents data on 10 influential scientific articles on curcumin, which contribute significantly to various medical, pharmacological, and biochemical fields. These articles have the potential to become an important reference in related research and are recognized as one of the most important publications. The high number of citations shows the importance of each article's contribution to the development of ongoing research. These include the article by Nelson KM,³⁹ published in 2017 in the Journal of Medicinal Chemistry, which records the highest average citations per year, at 172.75 citations. Nelson KM discusses the opportunities and challenges in developing future research on curcumin.³⁹ Furthermore, Yang F et al.¹⁶ in the journal Biological Chemistry (2005) obtained the greatest citations of 2150, with an average of 107.5 citations each year. Yang F et al reported that low doses of curcumin could effectively separate Abeta and prevent the formation of fibrils and oligomers, suggesting the potential of curcumin in clinical trials to prevent or treat Alzheimer's disease.¹⁶ The result has the potential to become an important reference in related research and is recognized as one of the most important publications in the field. Other articles were published between 2000-2011 with the exception of Singh S (1995)⁴⁰ This suggested that the decade was a highly productive and influential period for related research, comprising increased scientific knowledge on cancer biology, pharmacology, and therapeutic use of curcumin.

Table 2: Top 10 most cited documents related to current trends of curcumin

					Total Citation per
Paper	Year	Journals	DOI	Total Citations	Year
YANG F	2005	J BIOL CHEM	10.1074/jbc.M404751200	2150	107,50
CHEN A-L	2001	ANTICANCER RES		1967	81,96
GOEL A	2008	BIOCHEM PHARMACOL	10.1016/j.bcp.2007.08.016	1918	112,82
LIM GP	2001	J NEUROSCI	10.1523/jneurosci.21-21-08370.2001	1419	59,13
NELSON KM	2017	J MED CHEM	10.1021/acs.jmedchem.6b00975	1382	172,75
SINGH S	1995	J BIOL CHEM	10.1074/jbc.270.42.24995	1329	44,30
SUN D	2010	MOL THER	10.1038/mt.2010.105	1301	86,73
DHILLON N	2008	CLIN CANCER RES	10.1158/1078-0432.CCR-08-0024	1184	69,65
ZHUANG X	2011	MOL THER	10.1038/mt.2011.164	1113	79,50
ANAND P	2008	BIOCHEM PHARMACOL	10.1016/j.bcp.2008.08.008	1052	61,88

Conclusion

In conclusion, the publication trend of articles on curcumin from 1937 to 2025 showed a significant increase. Authors from developed countries such as the USA and China were the main contributors to the number of publications. Meanwhile, Indonesia, as a tropical country rich in curcumin resources, also showed significant contributions in related research. Despite the significant contributions, research on pharmacotherapy affecting the immune system, inflammation, and anticancer effects including curcumin should be carried out to support advances in the field of precision medicine.

Conflict of Interest

The authors declare no conflict of interest.

Authors' Declaration

The authors hereby declare that the work presented in this article are original and that any liability for claims relating to the content of this article will be borne by them.

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